# Learning, Innovation and Competence Building in SMEs: The Case of Indian Automotives

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## 1. Introduction

Since the early 1990s the increasing globalization and to some extent the internal liberalization have drastically altered the market structure and supply linkages in many industries in the emerging economies, exposing their SMEs to greater competition (e.g. Veloso and Kumar 2002). Yet the SMEs have opportunities for higher growth and exports, also through linking with the global supply chains. Appropriating these opportunities, however, requires sustained learning, innovation and competence building (henceforth LICs) by the locally-owned SMEs.

The automotive industry is tierized with potentially deep backward linkages. Globally there has been an increasing use of electronic and information technology, telematic applications, and lightweight and 'smart' materials. At the same time the cost-cutting is a major concern of OEMs (original equipment manufacturers). At the global level – also true of India - the automobile industry during the last decade has witnessed a tremendous rise in the modularization (OEMs buying assemblies/ sub-assemblies rather than components and parts), tierization, and vendor rationalization.[2] The safety norms have become more stringent.

The Indian automotive industry is a case of 'shift from much protection to intense competition' of the kind described above (Singh 2006).[3] The local content requirements and export obligations have been completely abandoned. Advancing the 1991 and 1997 FDI liberalization, the March 2002 Auto Policy allows 100% automatic foreign ownership (and without any minimum investment condition). The number of SSI reserved items has fallen over time; since mid-2006 there is no SSI-reservation of any 'auto components, ancillaries or garage equipment' used for motorized vehicles. In general, the quantitative restrictions on imports were scrapped w.e.f. April 1, 2002; the tariffs have been lowered since then. Many global OEMs have entered the industry since the mid-1990s, as also their preferred suppliers (follow-sources). They have also set up local offices for international procurement. With proliferating new vehicle models, flexible manufacturing techniques are required for numerous components.

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[2] These tendencies increase the 'distance' between SME component suppliers and vehicle assemblers, which may dent the bargaining power of these suppliers and the technical assistance received by them from their customers. Many erstwhile direct suppliers to Maruti, Tata Motors (Telco) and M&M have probably become Tier-2 or Tier-3 suppliers to them. For vehicle assemblers which entered India since the mid-1990s, at least for the critical components, mostly their follow sources and a few other large companies occupy the Tier-1 supplier ranks. The system integrator, Tier 0.5, is a new category globally.

[3] Singh(2006) discusses the implications of globalization for automotive SMEs in India. Tewari(2005) argues that compared to some other countries, India has followed a policy of strategic and sequenced de-regulation and liberalization.

All these developments have serious implications in terms of the operating environment faced by the SMEs. At the same time in India the auto components sector is being perceived as a 'priority industry', and a thrust area for exports, having optimistic projections for exports and overall growth. The 2002 Policy aims to make India a global hub for automotive components and a regional hub for small cars. Hence the auto component SMEs in India must gear up to meet the transition challenges. It will be highly rewarding for these SMEs to integrate into the global supply chains (Singh 2006).

Utilizing recent data (year 2004-05) for auto component firms, this paper analyzes the inter-firm variations of certain important conduct and performance indicators, under the broad theme of learning, innovation and competence building (LICs) in SMEs. In this econometric study the main variables being examined, by way of new evidence, are: having the internationally accepted quality management standards; and being an exporter to OEMs or (high) Tier companies. These issues are significant as the global/ regional outsourcing of components by automotive OEMs and Tier-1 firms is going up; and consistent good quality is essential for exports of components at these levels. The export participation and export intensity variations among firms are analyzed here additionally. Though focusing on the size-associated differences, we consider the role of a number firm-specific variables, including several foreign collaboration characteristics, and the locational (regional/ cluster/ isolation) variables. This paper also evaluates the cluster programs being conducted for automotive SMEs, primarily by UNIDO and ACMA.

Below, Section 2 discusses the institutional support; the cluster programs details are in Appendix 1. Section 3 deals with the firm-level analysis – the relationships examined; the sample, data and variables; and an analysis of results (Sections 3.1 to 3.3). Section 4 concludes with certain observations and policy recommendations.

## 2. Institutional Support

An innovative way of engineering LICs in small firms is by 'mentoring' groups of small firms. In the Indian auto component industry the UNIDO and the Automotive Component Manufacturers Association ACMA have taken an initiative in this regard through the cluster programs. These programs are essentially meant to make the participating firms aware of the best practices, adapted to the local conditions, and to prompt and assist them in adopting these practices. For details and an evaluation see Appendix 1.

ACMA has been engaged in upgrading the productivity, quality and technology levels of its members also through its other activities, like six-sigma training (aimed at reducing rejection rates), quality circles (for total employee involvement), and the ACT-ATOS of Japan specialized training programs on Lean Machine Systems. The ITC/ACMA(2004) publication is a commendable effort to make the SMEs understand the nuances of exporting. The Indian auto component industry has numerous family-owned enterprises. Recently ACMA has formed a Young Business Leaders' Forum comprising of first generation entrepreneurs and eventual inheritors of family-owned enterprises (ACMA 2006). The Forum is meant as an opportunity for the members to interact with the leading CEOs in this industry and to learn through visits to excelling companies.

According to an Exim Bank(2000) survey of auto component SMEs, for ISO 9000 certification these producers have been mainly using the services by private agencies rather than the usage of public institutions like BIS. The initial costs of installing the system are in the range of Rs. 6-7 lakhs, and the annual maintenance costs are Rs. 1-2 lakhs. ITC/ACMA(2004: 105) estimates the total expenses for a third-party 3-year certification as generally over $5000. The costs are thus heavy for SMEs. The government reimburses a part of the consultancy and audit charges for ISO 9000 certification (maximum Rs. 75,000) but the SMEs are often not aware of these schemes, or find the reimbursement procedures to be time-consuming, apart from the amount being somewhat inadequate. Also these subsidy schemes are not available for other quality systems which are considered more rigorous and of greater significance in the international automotive industry. The Exim Bank's financial support scheme for exporters, though not restricted to ISO 9000/ 14000 accredits, has been operating at a small scale for all industries.[4]

The need for technological advancement and innovation culture among SMEs cannot be over-emphasized. The CII-DSIR-IIFT(2004) survey finds approximately 35% automotive SMEs having no R&D. The average R&D intensity in the Indian auto components industry happens to be low, being only 0.5%, as against 3.0% for Japan and 5% for Germany (EU-Mckinsey Report, quoted in Exim Bank 2000: 60). Of the R&D activity, there is little Research component; it is primarily product/ process development – mainly improvements done at the suggestions of the customers. Increasingly the big buyers are only providing the product specifications and test requirements, while the product/ process engineering is done by the component manufacturers themselves (Exim Bank, 2000). Foreign players may be willing to transfer technology if given a majority control; most of the SMEs are not agreeable to that. For SMEs the financing of product development costs is a major concern. In the absence of an assured off-take and a long-term supply relationship, they are hesitant to commit their own limited funds. Exim Bank(2005) recommends a comprehensive program for technology development, while assigning a significant role to the direct financing measures and tax incentives.

For exports there are high transaction costs of marketing, product testing and order handling. The Exim Bank lends money for market development assistance. Some SMEs view the procedures relating to institutional finance (through EEPC etc.) for market development assistance as cumbersome; the amount is viewed as inadequate.

Low cost, easily accessible and credible testing facilities are particularly important for exports. For certain crucial components testing at ARAI is compulsory (Exim Bank 2000). Testing at the Regional Centres is perceived to be time-consuming. Private organizations like SGS offer prompt service and have stronger credibility with the customers. For exports to vehicle assemblers it is usually necessary to undergo

[4] See Exim Bank(1999: 63, 118). It provides financial support to cover 50% cost for any quality certification (75% for SSI units) for export-oriented units. BIS, a nodal agency for assistance in ISO 9000 and ISO 14000 (environmental standards) series, grants concessions on its fees to SSIs. Some private international organizations like BVQI provide ISO certification in India but their charges are often prohibitive for SMEs.

certification testing with an agency in the customer's country. The high costs of this are a big hurdle for SMEs, especially when repeated tests have to be conducted in iterative product development processes (Exim Bank 2000: 75). At present there are inadequate (shared) validation facilities in India. Several studies and our informal discussions with SMEs strongly point to the need for upgraded centralized testing facilities. The NATRIP project aimed at upgradation of these facilities should be completed at the earliest. Now India has signed the WP.29 1998 Agreement on automotive safety and emission norms.

In view of the long continuity of R&D projects, the scheme of 150% deduction of R&D expenses from taxable income, operational since July 2004, should be extended beyond 31/3/07 for another 10-15 years. Since April 2005 there has been an excise duty exemption for products designed and developed locally by Indian-owned firms and patented in either India, USA, Japan or any country in the European Union; ACMA wants this exemption for all firms operating in India (Economic Times, Feb. 28, 2006: 4).

In recent years some clusters have been identified for development under the Small Industries Development Programme and under the Industrial Infrastructure Upgradation Scheme of the central government. There is a need for greater coordination among SSI agencies and programs, and more industry-specific schemes. Clubbing together of small and medium enterprises (for several purposes) under the Micro, Small and Medium Enterprises Development (MSMED) Act, 2006 is expected to encourage technology upgradation and FDI in the SME sector. The National Manufacturing Competitiveness Council (NMCC) is keen to develop the auto components industry and address the problems of SMEs, through emphasis on cluster development. Though a number of initiatives have been taken by India since 2000 to promote the SMEs, there is a lot to learn from other countries' experience of facilitating the mentoring, skill and technology upgradation, information exchange, and linkages with domestic and foreign OEMs (see e.g. Exim Bank, 2005: Ch. III). The NMCC has recently commissioned ICRIER to benchmark the auto policies of other competing nations with the policy support provided to the Indian automotive industry (ACMA 2006).

China is a close international competitor for the Indian automotive suppliers. Hence we briefly mention its recent policies. At present a majority of the Chinese automotive SMEs suffer from low quality and technology constraints. The Chinese Automotive Policy announced in June 2004 aims to encourage the systems development ability of auto component producers (ACMA 2005). Those supplying several independent OEMs or entering global purchasing system will be supported in terms of technology upgradation, transformation, financing and organization. Vehicle manufacturers would be encouraged to source key automotive components domestically and these imports would be discouraged. Again, new projects for vehicles must meet certain minimum (substantial) investment requirements; for JVs the project proposal must append a contract for technology transfer and cooperation. These requirements would indirectly benefit the component industry. Again, China has an Innovation Fund for Small technology based firms (Exim Bank 2005:16). An SME network has been formed as an information network on regulations, policies, emerging technologies, sources of raw materials, demand trends etc. It also provides credit and guarantee services.

## 3. Firm-level Analysis

### *3.1 The Relationships Examined*

For core auto components the manufacturing is scale-driven; also the technology is complex and requires rapid upgradation. Increasing competition, cost-cutting by OEMs and technology are among the major challenges for SMEs.

The quality-conscious automotive component buyers generally insist upon certain quality management standards. International OEMs or Tier companies may require the supplier to meet either the internationally accepted standards, or the buyer country's standards. These certifications are costlier to acquire compared to the ISO 9000 specifications, and in some ways more stringent. We attempt to explain the acquisition (holding) of the international standards certification, ISO/TS 16949 (and of international and/or certain important country-specific standards; QClevel3 and QClevelG).

As the international markets usually pose greater competition, exports by the firm may be treated both as a conduct and performance variable. We examine the export participation (1-0 variable), XPosi, as well as the export intensity among exporters (Xint). In the export market the OEM or Tier buyers are relatively more quality and technology conscious customers. Having direct links with OEMs or Tier-1 automotive firms, especially the former, is also said to be conducive to quality and technology upgradation, and product improvement.[5] This study therefore focuses on the determinants of the vendor-association with international OEM or global Tier firms. We examine the 'Level of Exports', i.e. whether the firm is an exporter to OEMs, or to OEMs and/or Tier firms, or not (XlevelOE and XlevelOT).

With a view to analyze the LICs by SMEs, the focus explanatory variable here is the firm size. We also examine the effects of foreign collaboration, age of the firm, region/ location-specific factors etc. For the export related equations we also estimate the impact of having high quality standards. The role of quality standards, R&D and HRD as LICs is well documented in the existing literature.[6] Having separate in-charges for exports, R&D, quality or HRD, reflects the emphasis on theses activities. The HRD Dept. deals with training and skills issues, among others. The effects of having these incharges are explored. While examining the select averages, this study also discusses briefly the observed size-associated differences in the propensities to import technology (through technical and/or financial collaboration), and having separate in-charges for exports, R&D, quality or HRD.

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[5] For the present sample, only a small number of the firms selling domestically do not supply to a domestic OEM. However, with a few exceptions, they supply at least to a domestic Tier-1 firm.

We may mention that the auto component industry consists of several product categories, each dominated (at least 75% share) by 3-5 players in India (ICRA studies). One must also mention significant components manufacturing by associated firms of local and foreign OEMs and the existence of auto component Groups.

[6] Basant et al.(1998), Chaturvedi(2003), CII-DSIR-IIFT(2004) and Singh(2006) discuss the related constraints and challenges for auto component SMEs, and suggest measures for their capability building.

The main hypotheses tested are discussed under the specification of individual equations below. For the binary (1-0) variables to be explained we obtain the logistic regression estimates; both the coefficients and odds-ratio estimates are presented.[7]

**Quality Certification Levels (Eq. QClevel3 and QClevelG)**

The efficiency of vehicle production and running is closely linked to that of the supply base. Many parts and tools are model-specific. OEMs insist upon high quality standards from their component and sub-assemblies suppliers, and therefore, the Tier-1 and 2 suppliers too in turn. Though quality maintenance is a regular continuous process, having acquired third-party quality certification facilitates, or may be mandatory for, supplies to certain customers.[8] We examine the factors determining the likelihood of acquisition (holding) of certain quality standards, and later also evaluate their impacts on the exports by the firm and the probability of exporting to OEMs or Tier companies.

***Quality Certifications in Practice***: There are a number of quality management standards (QMS). Also, there have been major changes in these since 2000 (ITC/ACMA 2004). The ISO 9001:2000 improves upon ISO 9000:1994 (and ISO 9001:1994) by introducing certain new aspects and reducing the documentation requirement. With this revision of standards in Dec. 2000, the 1994 series was to be withdrawn (becoming invalid) after 3 years. ISO 9001:2000 integrates ISO 9001, ISO 9002 and ISO 9003; ISO 9004:2000 provides a methodology for further improvement (www.iso.org). All these standards are part of the ISO 9000 family. There are also American (QS-9000), German (VDA 6.1), French (EAQF) and Italian (AVSQ) quality management standards – based on ISO 9001:1994; of these, QS-9000 is globally the most accepted standard. E-mark/ e-mark is a European standard (covering also E. Europe) for vehicles, sub-assemblies and auto components (Internet Sources). Absence of Agreements on Mutual Recognition of Standards acts as a non-tariff barrier.

ISO/TS 16949, meant specifically for the automotive industry, is an ISO technical specification, aligned with the existing American, German, French and Italian standards mentioned above. ISO/TS 16949:2002 was prepared by the International Automotive Task Force, represented by an international group of vehicle manufacturers, and Automotive Associations from Japan, USA, Germany, France and Italy. It eliminates the need for multiple certifications, thus recognized as a harmonizing agent. ISO/TS 16949:2002 has been integrated with ISO 9001:2000. It specifies the quality system requirements for the design and development, production, installation, and servicing of automotive-related products; in addition there are customer-specific requirements for the subscribing individual vehicle manufacturers (ITC/ACMA 2004: 109). The ISO/TS 16949:1999 registrants were required to upgrade to the 2002 version by Dec. 2003.

[7] A linear probability model states $P(Y=1 \mid X_i) = \beta' X_i$ but the predicted probability can lie beyond the 0-1 range. This can be overcome by modeling the probability as a function $G(\beta' X_i)$. A logistic cumulative distribution function is used here. The ratio of $P(Y=1)$ to $P(Y=0)$, called odds ratio, is $\exp(\beta' X_i)$; the coefficients (estimates of $\beta$), being in log-odds ratio units, are more difficult to interpret. The Psuedo-$R^2$ is 1 minus (the ratio of unrestricted to restricted log likelihood).

[8] Productivity enhancing measures like TPM, TPS and six-sigma practices also contribute to quality upgradation.

Again, with the ISO/TS 16949:2002 coming into force in 2003, the QS-9000 document was to be suspended.

In India the quality level required for even the domestic supply of auto components has risen, in view of the more quality-conscious domestic customers of vehicles and rising exports by OEMs in recent years. The foreign exchange neutrality (export obligation) and localization requirements imposed under the 1997 Auto Policy on new foreign investors in the vehicle segment contributed substantially to improving the quality of components produced in India, reduced the customer-rejection rates and led to skill upgradation (see e.g. Chaturvedi 2003; Okada 2004; Singh 2004; ICRA sources). A primary survey by Singh(2004: 37) reveals that since the 1991 liberalization the automotive firms have responded by way of the maximum emphasis on improving quality standards; on a scale of 0 to 3 (most important), this average scale for component firms is 2.85.[9] Many firms have multiple quality accredits; the new additional plants by existing firms are usually set up with more advanced standards.

Out of 466 firms covered in this study, 237 and 139 have ISO 9000 and QS 9000/ E-Mark quality accredits. It is remarkable that 244 of these 466 firms have ISO/TS 16949 certification (257 out of 512 firms listed in Buyer's Guide 2006). In comparison, ACMA(2004, Industry Overview) mentions ISO/TS 16949 certifications for only 99 of its 467 'members' – information probably based on an earlier year's "Buyer's Guide" reporting 2001-02 or 2002-03 data. This implies a remarkable increase in this quality accredit in recent years. Exim Bank(2000: 65) reports that during 1997-98 of the 360 ACMA members, 180 had achieved ISO 9000 certification while about 30 had received QS 9000 certification. Thus the industry (ACMA members) seems to have significantly moved towards the globally accepted standards among OEMs and Tier-level buyers. A significant number of firms have also received the Deming and other prestigious international awards.[10]

***Hypotheses examined***: In the present sample 7% firms, primarily SMEs, are without any quality certification. Since 93% of the firms have acquired one or more quality accredits, we analyse only the type/ level of quality certification. We call the ISO 9000 family of quality certifications as QC1. We label all the foreign country or region-related certifications, e.g. QS-9000 or E-mark, as QC2. ISO/TS 16949 is labeled as QC3.

We call the presence of ISO/TS 16949 (i.e. QC3) as QClevel3, and the presence of QC2 w/o QC3, as QClevel2. The presence of only QC1 is labeled QClevel1. The discussion

[9] This average is 2.00 for seeking new technology tie-ups and 1.85 for increasing the R&D efforts. The author's recent discussion with some SMEs executives corroborates these tendencies. The major changes have come after 1998. The main source of technical/ product improvement is the in-house modifications.

[10] A Report by the Indian School of Business, New York Univ., Purdue Univ. and Deloitte Research, '*Indian Manufacturing in a Global Perspective: Setting the Agenda for Growth*' (Nov. 2005, mimeo.) quotes evidence from a multivariate study analyzing productivity growth for Indian auto component firms during 1993 to 2003, using CMIE PROWESS data. Controlling for other factors like size, age and export orientation, firms having quality certification did not perform significantly better than non-certified firms. The study does not distinguish among different types of certifications. Deming award winners had higher productivity growth rate. We believe that the causation is (primarily) the reverse.

above and the OEM-exporter status (XlevelOE) regressions support this ordering; exports to OEMs are generally the most demanding in terms of quality specifications. Further, as expected, the preliminary regressions indicate that in the presence of QC3, QC2 certification does not add significantly to the probability of having high export levels (i.e. OEM or Tier levels). Hence later we consider the effects of QClevel3 and QClevel2, keeping QClevel1, as the base category. Alternatively we employ QClevelG (=QClevel3 + QClevel2), the globally accepted standards, instead of QClevel3 and QClevel2 variables separately.

We explain the factors affecting the likelihood of adopting QClevel3 (i.e. ISO/TS 16949) and QClevelG (i.e. ISO/TS 16949 and/or QS-9000/ E-Mark type) quality certification. A close examination of the data reveals that foreign-owned firms having non-Japanese ownership have a very high proportion of adoption of non-ISO 9000 standards (QClevelG). Therefore, the inter-firm analysis of QClevelG is limited to the sub-sample of Japanese and locally-owned firms (N=414). QClevel3 is examined for the entire sample.

Smaller firms may find it difficult to meet the organizational requirements and the expenses involved in third-party certification, especially for non-ISO 9000 type standards. Like the firm size (Sales), also age may have a positive effect on the probability of adoption of globally accepted standards, as some firms gradually switch from ISO 9000 to these standards (or establish new plants with higher standards). On the other hand, the firms set up in recent years, might have started with high quality standards, keeping in mind e.g. the export opportunities. Also their managers may be more open to the use of advanced techniques (Parhi 2005). We allow for a non-linear effect of the age (Age, Age2). We also explore whether firms having an R&D or HRD incharge (RDInch, HRDinch) tend to adopt high quality standards.

Firms entering into a foreign collaboration may be encouraged or asked by the collaborator to update their quality standards. We differentiate between pure technical collaboration and FTCs, i.e. financial-cum-technical collaboration (PTCDum, FTCDum). For financial collaboration, we also attempt to capture any differential effect on SMEs (FCD, FCD_SME), and the differences across foreign nationalities in these propensities. Again, as explained below, it would be interesting to find whether compared to minority foreign ownership firms, majority (>=50%) foreign equity (FE) firms are more likely to adopt high quality standards. For this we employ Low_FED and High_FED variables.[11]

UNCTAD(2003: 27) quotes from earlier empirical studies indicating discrimination by the foreign collaborator against mandatory JVs/ low FE collaboration firms in matters of employment of cutting-edge technology and technical training to workers. The difference may be significant if comparing export-oriented wholly/majority foreign-owned enterprises and JVs oriented towards host country markets. In the former case "… the parent companies upgrade technology and quality control – in their own self-interest – on a continuous near-real time basis." (Moran 2003: 8) Yet, Korea, not allowing majority

[11] For QClevelG Eq. estimation, given the sub-sample, apart from Japan (Japanese ownership), no other financial collaboration characteristics is considered.

foreign ownership till 1987, has managed the technology acquisition well with licensing and minority foreign ownership/ JVs. "The Korean international success was also much affected by original equipment manufacturing for foreign TNCs, through which important flows of production methods, quality control practices, and management procedures were channelled back to local suppliers" (UNCTAD, 2003: 27-28); about 60-70% of Korean exports till 1980s were via OE manufacturing contracts.[12] Again, in general, the local partners of JVs may be keener on local absorption and diffusion of whatever technology is transferred to the enterprise for production (Singh 2005), and thus to adopt high quality standards.[13] So the ISO/TS 16949 adoption tendencies may be similar for minority and majority foreign-owned firms.

We have not come across any econometric study of the determinants of 'high' quality certification or export 'levels'. Based on a 2002-03 cross-section survey of over 100 auto component firms in India, Parhi(2005) examines the adoption of advanced manufacturing techniques, AMTs, in terms of firm-specific and socio-economic factors. The logistic regressions indicate positive effects of size (or R&D) dummy, participation in trade fairs, age, and skill. The effect of being a supplier to foreign OEMs is consistently positive. Again joint training participation (HRD cooperation) has a positive impact on the probability of adoption. The joint production/ problem-solving cooperation has a negative influence; perhaps the access to some common facilities can reduce the need for in-house AMTs-using equipment. The Gurgaon cluster employs AMTs more intensively. The model assumes the absence of information asymmetries. She does not consider the role of technology import with or without FDI; the local-foreign ownership composition of the sample is not mentioned.

Next we specify the equations pertaining to exports-related variables. A few general observations are in order. The ACMA-McKinsey Report(2005) predicts annual auto components exports of $20-25 billion from India by 2015 (and total production of $33-40 billion). During 2005-06 these exports were approx. $1.8 billion, forming about 18% of the industry production. India is emerging as a sourcing hub for global automotive majors. For exports, a consistent good quality, meeting delivery requirements and price competitiveness are the most critical operative factors (Singh 2004).

**Export Participation (Eq. XPosi)**

We first inquire what factors differentiate an exporter from non-exporter, namely the probability of being an exporter (XPosi). Given the fixed costs of exports, a larger firm is more likely to export. Having a trademark may facilitate being an exporter. Trademark plays a role similar to brandname in case of a final product. Older firms are likely to have a higher proportion of exporters to non-exporters, since once a firm turns an exporter, it is likely to remain so. However, a major surge in export opportunities for the industry or certain export promotion policies can lead to the emergence of exclusively or primarily

[12] This highlights the importance of OEM or Tier-level exports that we analyze later.

[13] Analysing the absorptive capacity of South African auto component suppliers, Lorzentzen(2005) argues that with MNC-control, despite the adoption of the possible frontier technology, there are chances of some de-skilling of the local operation; e.g. the process design and product R&D activities may be discontinued subsequent to the foreign ownership. There are some such instances also in the Indian automotive industry.

export-oriented firms, thereby somewhat counterbalancing the positive effect of age. The impact of any foreign collaboration is potentially favourable, but the export restrictions (see e.g. Singh 2004), formal or otherwise, may work to the contrary.

The quality-related variables – namely having a Quality Incharge or a high level of quality certification – are expected to promote exports, especially to OEMs/ Tier firms. In practice, much depends upon the technology intensity of exports and the role of cost competitiveness, as well as the use of informal mechanisms to ensure minimum quality requirements. However, establishing quality systems and acquiring certification can reduce the expensive and time-consuming quality inspections carried out by prospective buyers (Exim Bank 2000: 63). In India, apart from the public sector unit BIS, there are a number of private agencies involved in the ISO 9000 certification. In the case of ISO 9000 accredit, the buyer's (importer's) perception of the creditworthiness of the local certifying agency is relevant too. Having R&D and HRD incharges can contribute to the firm's ability to export.

A firm located in a major auto cluster town or in an Industrial Development Estate/ Area may enjoy agglomeration economies, also by way of shared resources and information which are particularly important to SMEs. We call the firms located elsewhere as isolated. Notwithstanding infrastructural deficiencies found in many clusters, a number of official committees, including the National Manufacturing Competitiveness Council, and Exim Bank studies (e.g. Exim bank 2005) highlight the importance of clusters in providing common facilities and labour training; see also Singh (2006). Thus the effect of isolation on export participation is likely to be adverse, especially for SMEs. This may be also true for the effect on OEM/ Tier exports. Hence we expect negative coefficients on Isol and Isol_SME variables.

**Export 'Levels' (Eq. XlevelOE, XlevelOT)**

From a position of mostly aftermarket (i.e. replacement market) exporter barely a decade ago, India has turned into a major sourcing hub for global OEMs and Tier 1 or 2 firms.[14] A high 'Level' of exports, i.e. being an OEM or (high) Tier level exporter, is an indicator of the adoption of advanced technology and quality standards, as the foreign OEMs are said to be more technology and quality conscious. Besides, the direct exports to OEMs usually consist mainly of critical components. We analyse the determinants of being an exporter to OEMs (XlevelOE). Alternatively the OEM/Tier level exporter status (XlevelOT) is examined.

Compared to exports to the aftermarket, exports to OEMs or Tier companies, specially the former, are likely to have more rigorous quality requirements. Lead-time (final order to delivery) and on-time delivery logistic capabilities are also considered. Again global OEMs these days want to share the finished product warranties with their suppliers; the product recall liabilities act as a deterrent for small suppliers. It is also difficult for SMEs to navigate through the plethora of RTAs and FTAs, and the associated rules of origin for direct exports. Further the coexistence of several customer-specific quality requirements,

[14] However, the exact value figures by these categories are not available. During 2005-06 only about 30% of exports of auto components were to the aftermarket (Economic Times, April 20, 2006: 7).

e.g. certification of plant and product, poses additional problems, especially for SMEs. Bigger firms may enter into overseas marketing alliances for exports, directly favouring OEM/ Tier-level exports. For SMEs the lack of exposure to foreign OEMs or Tier firms is another major concern. They have insufficient funds for global marketing and doubts persist regarding their delivery capabilities (Singh 2004), especially to supply a mega export order. Hence small firms may find it particularly hard to export to OEMs or Tier firms. Bigger firms are more likely to establish direct supply contacts with foreign OEMs or Tier firms.

The OEM/ Tier level linkages once set up, are likely to be long-term; on the other hand, many new firms have been set up in the post-liberalization period employing sophisticated machinery and technology to cater mainly to OEM or Tier exports. Hence the effect of age is uncertain. Having an R&D incharge is likely to exert a positive influence, especially on XlevelOE. The suppliers of auto components tend to modify or develop products according to the customer specifications, though it may often happen as informal R&D.

In the light of the earlier discussion we expect favourable effects of the quality variables Qinch, QClevel3 and QClevel2; and the effect of QClevel3 is likely to be bigger than that of QClevel2. Again the quality variables are expected to be most important for the OEM export, i.e. compared to that for the Tier-level and other exports.

For high-end critical components the technology is complex and proprietary, and may be held by MNEs. The effect of a foreign collaboration depends on the extent of technology transfer in a broad sense – including quality management and organizational practices – as well as any export restrictions, or whether the MNE decides to use India as an outsourcing hub.

The literature pertaining to the performance requirements on foreign investors refers to the likely consequences of joint venture (or low FE %) condition imposed by the host countries (see e.g. UNCTAD 2003). One strand of argument is that allowing majority FE promotes the exports. In that case, for an automotive component firm the exports to the collaborator and its major OEM customers worldwide would be favourably affected. We examine this possibility indirectly through the minority and majority foreign ownership effects on XlevelOE and XlevelOT. We additionally explore the effect of foreign technical collaboration – pure and FTC separately. Since our data is cross-sectional, we are able to estimate these impacts only during the validity of the ongoing technical collaboration(s), i.e. not of the erstwhile technical collaborations.

**Export Intensity and Exports-Log (Eq. Xint, ExportsL)**

Next we examine the determinants of export intensity(%) and the value of exports in log terms, ExportsL. For this we exclude non-exporters (151 units), and marginal exporters (19 units), namely those having exports below $ 0.025 million (approx. Rs. 1 million). The export intensity in this sub-sample of exporters ranges from almost zero to 100%.

The main relationships examined here pertain to the effects of firm size, foreign collaboration, R&D and quality-related variables and isolation factor. The discussion above alludes to the effect on export propensity as well. We may add here that overseas production facilities set up/ acquired by some relatively large firms, mainly a limited recent phenomenon, can partially substitute the exports. While a bigger size and foreign collaboration relax the constraints to exports, this may not necessarily lead to a greater export-orientation in terms of the ratio to sales. Some relatively small firms may operate as 100% or primarily export-oriented units. Singh(2001) argues that local partners in minority foreign venture may find the exports as integral to the firm growth. She finds a superior 'exports growth' performance by these firms relative to majority FE firms.

### *3.2 The Sample, Data and Variables*

**The Data and the Sample**: The data are compiled primarily from ACMA's publication "Buyer's Guide (or Source India)" for recent years, covering also some ACMA non-member firms. This data set, collected and published annually by ACMA - basically to provide the firm-profile to prospective buyers - has remained largely unexplored for a micro level analysis. After processing this data, we supplemented it by the company and internet sources to fill the occasional gaps for some variables. Though there is a large variation in the size of these firms, the ACMA data mainly pertains to (a part of) the top layers of the auto component and parts industry; this tierized industry has over 10,000 units in the unorganized sector.

The year of the analysis is 2004-05. For a small minority of cases the data are not available for 2004-05; for those the 2003-04 or else 2002-03 data are utilized; their sales and exports figures are accordingly adjusted, applying the Indian auto components industry production ($ values) growth factor. Firms for which even these sales figures are unavailable and/or the number of employees are not reported, have been excluded from the sample. This leaves us with 466 observations (out of 512 listed by ACMA). Among the (>= 10%) foreign-owned firms, about 40% units have Japanese ownership, and about 35% enterprises have majority foreign equity. We may mention that the auto parts and component industry is an agglomeration of industries. While labour intensive components, like engine components, offer some advantage to small firms, the skill-and technology-intensive segments like electronic items pose disadvantages.

**Variables**: Given the data availability, most of the variables are qualitative in nature.

***Continuous Variables***
*Age*: Age in 2005 since commencing production (truncated to 50 years; a few cases)
*ExportsL*: Exports ($thousands) $\log_e$
*SalesL*: Sales ($million) $\log_e$
*Xint*: Export Intensity(%); ratio of exports to sales
*PureTC*: (Foreign) Pure technical collaborations (No.)
*TC*: (Foreign) Technical collaborations (No.)

***Dichotomous (1-0) Variables***

Location (of main plant) variables:-

*East, North, South, West*: The Region

*ClusEJ, ClusNF, ClusNG, ClusSBH, ClusSC, ClusWP*: Located in auto cluster town East-Jamshedpur, North-Faridabad, North-Gurgaon, South-Bangalore/Hosur, South-Chennai, West-Pune,

*Isol*: Isolated; located neither in any major auto cluster town (mentioned above) nor in any industrial development area/ estate

*Isol_SME*: Isolated SME (Isol*SME)

Incharge Variables:

*HRDinch, Qinch, RDinch, Xinch*: Having HRD, Quality, R&D, Exports Incharge

Foreign Collaboration Variables:

*FCD*: Financial collaboration dummy

*FCD_SME*: SME having financial collaboration (FCD*SME)

*High_FED*: High (>= 50%) total foreign equity dummy

*Low_FED*: Low (10 to <50%) foreign equity dummy

*Germany, Japan, USA, OthNat*: Nationality of (major) financial collaborator. OthNat is nationality other than Japan, Germany or USA. *Non_Japan* = Germany + USA + OthNat

*FTCDum*: Financial-cum-technical collaboration dummy

*PTCDum*: Pure technical collaboration dummy. Some foreign-owned enterprises have technical collaboration even with firms other than the financial collaborator(s).

*TCDum*: Technical collaboration dummy (= FTCDum + PTCDum)

Quality Certification (QC):

*QC3, QC2, QC1*: Having ISO/TS 16949; any foreign country/ region specific (e.g. QS-9000, E-mark); ISO 9000 (or BIS-mark) quality certification

*QClevel3*: Highest certification level ISO/TS 16949 (QC3 with or without QC2 and QC1)

*QClevel2*: Highest certification level QS-9000/E-mark (QC2 w/o QC3; with or w/o QC1)

*QClevel1*: Highest certification level ISO 9000 (QC1 w/o QC3 and QC2)

*QClevelG*: QC level globally accepted (=QClevel3 + QClevel2); having QC3 and/or QC2

*QC*: Any quality certification (= QClevel3 + QClevel2 + QClevel1). *QC_None*= (1 – QC)

Other Variables:

*OthD*: Non-Company Dummy (0 for public/ private limited company)

*SME*: Small or Medium Enterprise (upto 200 employees). Small firm is upto 100 employees. The investment data is not available.[15]

*TM*: Having Trademark

*XlevelOE*: Export-level OEM; being Exporter to OEMs[16]

[15] Till recently, the 'Medium scale' sector was not defined formally in India. The Micro, Small and Medium Enterprises Development (MSMED) Act, 2006 defines the medium sector as firms having >Rs. 5 crores to upto Rs. 10 crores investment in plant & equipment, and raises the limit for Small firms from 1 crore to 5 crores. Internationally there is no uniform definition of SMEs (see Exim Bank 2005: 6-9).

[16] Some firms have mentioned exports to tier companies under the category 'exports to international vehicle manufacturers'. In order to cross-check this information (for correction) we referred to the 'List of Automobile Manufacturers' in different countries obtained from Wikipedia website and also to the 'Buyer's

*XlevelOT*: Export-level OEM or Tier; being Exporter to OEMs or Tier firms
*XPosi*: Exports positive, i.e. export participation.[17]

**Some Remarks on Variables**: The effect of foreign ownership is captured through 'FCD, FCD_SME' or 'Low_FED, High_FED' variables alternatively. This is to allow for the differential effect for SMEs and non-SMEs, or for low vs. high FE(%). The differential effect of foreign nationalities is estimated too as the corporate practices and internationalization strategies differ across FDI home (source) countries. This is relevant also in the context of a post-facto evaluation of the earlier policy of subtly encouraging inward FDI by Japanese MNEs vs. other MNEs. ACMA and SIAM(2003) refers to the 1983-1993 period as the 'Japanisation Phase' for the Indian automotive industry (1985-1991 for the components segment). We employ the USA, Germany and OthNat dummies, with Japan as the base category. The effect of pure technical and financial-cum-technical collaboration is examined separately through PTCDum and FTCDum variables.

For the size variable (Sales) we considered alternatively (Sales, Sales2) and (SalesL, SalesL2). The log formulation appears to be better; its quadratic term is generally highly insignificant, and therefore dropped from the preferred specifications. The Othd dummy is employed as some singly-owned or partnership firms may not be as professionally run as companies. The sample has 48 non-companies, all locally-owned. SMEs in general may not be adequately aware of the intellectual property rules. They find it costly to register and maintain patents. Some SMEs may not even register their trademarks. Here we explore the effect of having a trademark on the export performance.

Our sample data indicate geographical concentration of firms in Gurgaon and Faridabad in the North, Chennai and Bangalore/Hosur in South, Pune in West and in the East in Jamshedpur. The different regions and clusters differ in terms of the product specialization, proximity of OEMs, FDI level and entry timing, the vicinity of shared (government) testing and certification facilities, etc. In preliminary regressions we experimented with various formulations involving the locational variables. Subsequently we have employed North and South regional dummies (thus West and East being the base), and ClusNG, ClusNF, ClusSC and ClusSBH cluster dummies. For the preferred specifications we drop the locational dummies which have insignificant coefficients.

**Select Averages**: We first compare some important average values by size categories, i.e. for Small (upto 100 employees), Medium, and Large (>200 employees) firms, as reported in Table 1. The likelihoods of having a quality certification and the Quality, HRD, R&D and Exports Incharge are higher for medium-sized compared to Small firms, and are still higher for Large firms. However, such size-related differences are quite sharp for high

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Guide' for earlier years. The disaggregate value figures are not available for exports to OEMs, Tier firms and the aftermarket.

[17] A few firms do not report any exports but mention being an aftermarket exporter. Those exports may be negligible or might have started by the time of sending the filled Performa to ACMA. We treat them as non-exporters for the period of the analysis.

level of quality certification, say QClevel3 (ISO/TS 16949), as well as for being an exporter to OEMs or Tier firms.

The export participation is relatively low for Small firms, but similar for Medium and Large firms. Medium-sized firms have the highest export intensity if we consider both the exporters and non-exporters. The average export intensity among exporters (Xint divided by XPosi) is 38.005, 26.054 and 19.353% for Small, Medium and Large firms; it is 31.121% for SMEs and 23.565% overall. There is a noticeable difference across size categories in the average propensity to enter into a foreign financial or technical collaboration, the average being the lowest for Small firms. The CII-DSIR-IIFT(2004) survey also finds the absence of such linkages for most of the SMEs. We find the difference between SMEs and Large firms to be quite sharp for pure technical collaborations and for minority foreign ownership, while the proportion of High FE cases is not much dissimilar. This may be due to lower bargaining power of SMEs.[18]

Table 1 also shows that compared to locally-owned firms, foreign-owned firms have a higher probability of having QClevel3 (ISO/TS 16949 certification) or QClevelG, and are more likely to have separate Incharges for Quality Control, HRD and R&D. They have higher export participation but lower export intensity; their probability of being an OEM or Tier level exporter is greater. However, given the much larger average size of foreign-owned firms, many of the above-mentioned differences would be marginal if we compare Large local and Large foreign firms. However, apart from having technical collaborations with their financial collaborators, foreign-owned firms also seem to have a greater tendency (than local firms) to conclude pure technical collaborations.

### 3.3 Analysis of Results

We now analyse the results of the multivariate analysis.[19]

### Quality Certification

Table 2 reports the estimates of QClevel3 Eq. explaining the likelihood of adoption of internationally harmonized quality standards ISO/TS 16949. Estimates of QClevelG Eq are reported below. There is a considerable and highly significant effect of the firm size (SalesL) on QClevel3. Looking at the b-coefficients of Age and Age2, there is a positive effect of the firm age but it becomes negative after about 20 years. The Southern region as a whole, and in the North Gurgaon-located firms (ClusNG) have a greater tendency to

[18] Since 1991 upto 24% FDI is allowed in SSI units. High R&D costs and technology complexity are driving SMEs to seek global linkages and alliances (Exim Bank 2005: 48). However, SMEs have difficulty in finding minority foreign collaboration partners; some SMEs fear being turned into a minority local partner later (private conversations with the author). Foreign collaborators generally want a majority ownership but the local firms are uncomfortable about it. At the same time the SMEs feel that foreign collaborators are hesitant to transfer crucial technology.

[19] We also examined the likelihood of having exports, quality, R&D and HRD incharge. These logistic estimates have generally low explanatory power (results not tabulated here). Broadly, these results point to a strong consistently positive effect of size on Xinch; for other incharges, the effect is positive only initially (till about the medium size) and then negative. Isolated SMEs are less likely to have Quality and R&D incharges. As for foreign collaboration variables, a high FE has a positive effect on Qinch; a low FE or pure technical collaboration have positive effects on RDinch,. The Age has usually small positive effects. Non-companies have a higher probability of having Xinch but a lower one for RDinch and HRDinch.

hold QClevel3 certification. R&D and HRD Incharge variables do not exert any significant influence on the quality certification level QClevel3 (or QClevelG). In preliminary regressions HRDinch has a small and weak favourable effect on QClevel3.

A pure technical collaboration strongly induces the acquisition of QClevel3. As for the effect of foreign financial collaboration, a high vs. low FE(%) seems immaterial. For Large (non-SME) firms, the effect of a financial collaboration (FCD) is slightly negative and weak, except in the case of German ownership. However, SMEs in general benefit from a financial collaboration (coefficients of FCD and FCD_SME added), as it appears to prompt them to greater adoption of QClevel3. Among different foreign nationalities, German firms are far more likely to adopt ISO/TS 16949 certification, consistent with the impressionistic evidence.

The QClevelG Eq. (given below) is estimated for the sub-sample of Japanese and locally-owned firms. It indicates that even for QClevelG (i.e. all non-ISO 9000 type quality certification), there is a very strong and significant influence of the size of the firm (SalesL) and of having a pure technical collaboration (PTCDum); these effects are very similar on both QClevel3 and QClevelG. As expected, non-companies (singly-owned or partnership firms) have a lower likelihood of adopting any 'global' quality standards, QClevelG; however, the Othd coefficient is not significant for QClevel3 Eq. ClusNG (Gurgaon) location has a rather weak positive effect on QClevelG. The Japanese ownership (Japan) variable, having insignificant coefficient, has been dropped here.

QClevelG = 0.657 SalesL - 0.620 Othd + 1.192 PTCDum + 0.562 NG - 0.654
(6.924) (1.643) (2.763) (1.449) (3.125)
LR Chi2 = 110.55 Psuedo R2 = 0.206 N = 414
[Note: The odds-ratio is 1.929, 0.538, 3.295 and 1.755 respectively.]

**Export Participation**

In general, smaller firms tend to have somewhat lower export participation, as indicated by a weak positive coefficient on SalesL (XPosi Eq., Table 3). Being 'isolated' renders an SME far less likely to be an exporter; the odds-ratio of Isol_SME variable is just 0.202 (Table 4); a similar effect is seen for being an exporter to OEMs or to OEM/Tier firms.

Another notable result is that a high level of quality certification or having a Quality Incharge is not positively related with being an exporter; nor is the R&D Incharge variable significant here. The reason may be that the exports to aftermarket or lower Tiers may be equally possible with ISO 9000 certification or sometimes even without it. The export participation tends to increase significantly with age, and having a trademark or HRD-Incharge. The HRDinch coefficient may be reflecting the effect of skill formation and training factors; the effects of HRDinch on XlevelOE and XlevelOT are rather weak. Chennai cluster firms are more likely to be an exporter.

In general, the foreign ownership, even a high degree of it, does not lead to greater export participation. In an alternative regression, compared to Japanese firms, non-Japanese

firms as a group seem more likely to export, but the tendency is barely significant at 20%. Again, a pure technical collaboration has a rather weak positive effect.

**Export 'Levels'**

As expected, the firm-size (SalesL) has a consistently large and highly significant positive effect on XlevelOE and XlevelOT; the effect is bigger and more significant for XlevelOE. Age of the firm seems unimportant.

For OEM level exports, among ISO 9000 family, QS9000/ E-mark and the harmonized standards ISO/TS 16949 quality certifications, the last one stands apart as supreme. Among the firms without ISO/TS 16949, those having QS9000/ E-mark seem to generally show a superior performance relative to those with (only) ISO 9000 certification. As seen in Table 3, compared to QClevel1, the presence of QClevel3 seems to substantially increase the likelihood of being an OEM-exporter. The positive effect of QClevel2 is smaller and rather weak for XlevelOE. However, for XlevelOT both the QClevel3 and QClevel2 appear to have similar effects. Hence for the preferred XlevelOT specifications we include QClevel1 variable instead. Thus an upgradation from ISO 9000 to ISO/TS 16949 certification – the globally accepted harmonized standards for automotive products – would be instrumental in promoting exports to (high) Tier level and especially OEM-level exports.

The importance of quality factors for OEM-level exports is also highlighted by the favourable effect of having a Quality Incharge (Qinch).[20] The Qinch coefficient is not significant in XlevelOT Eq. Neither the HRD nor the R&D Incharge variable is significant for either of the equations. The TM coefficient is positive, but not significant in XlevelOE Eq. Given the quality-related variables, the non-companies (OthD) manage to have at least as high export participation and 'levels' as companies.

*Ceteris paribus*, relative to Japanese-owned enterprises, all other foreign-owned firms show a greater tendency to be an OEM/Tier exporter. As for exports to OEMs, compared to Japanese financial collaboration enterprises, those having financial collaboration in othNat category (i.e. non-US and non-German) have a far higher probability of being an OEM-exporter. The Germany and USA coefficients are also positive; the former is generally significant at 5-10% level, while the USA coefficient has lower significance level.

Relative to Low FE foreign-owned firms, high FE(%) units have a smaller probability of being an OEM level exporter. Such an adverse effect of High_FED is even bigger and more significant for OEM/Tier level exports. For export 'level' equations the FTCDum coefficient is negative and generally significant, implying an adverse effect of an FTC. The pure technical collaboration (dummy, PTCDum) has no significant effect. Considering the coefficients of all financial collaboration variables together (including FTCDum), the net 'b' coefficient value in case of Japanese ownership is negative if

[20] A logistic regression of XlevelOE only in terms of the quality-related variables indicates larger and more significant coefficients of these variables (the results not tabulated).

having a high FE or an FTC. In other nationality cases the net effect is positive without FTC and high FE; else, the effect is small. Similar tendencies are found for XlevelOT.

Overall, the net effect of foreign ownership seems negligible for XlevelOE and slightly positive for XlevelOT. The partial favourable effect, if any, appears smaller for SMEs (negative coefficient on FCD_SME). These results strongly reject the argument that a high FE ratio would encourage exports (being an exporter) at OEM or Tier level. Nor do these results indicate strongly that a foreign financial collaboration is superior to a technical one. It must be added that these results pertain to the OEM/ Tier exporter status (1-0 variable), and not to the value or intensity of exports at these levels.

A noteworthy finding is that ceteris paribus, among SMEs the 'isolated' ones (Isol_SME=1) are far less likely to be an OEM/Tier exporter; the separate effect on XlevelOE is not statistically significant. Northern firms have a slightly lower likelihood of being OEM-level exporters, though not for XlevelOT. Faridabad cluster (ClusNF) lags behind, also for XlevelOT. Firms in Chennai cluster (ClusSC) seem far ahead of other firms for XlevelOT. The remaining South has a somewhat poorer performance; ClusSBH coefficient is negative but not consistently significant.

Overall, the results highlight the importance of quality-related variables, namely the presence of harmonized standards ISO/TS 16949 and having a Quality incharge, for high 'level' of exports. Small-sized firms and isolated SMEs seem to be constrained in this regard. The net effect of foreign ownership on 'high level of exports' is not highly favourable. The effect varies across nationalities, and the Japanese firms seem less forthcoming in this respect. High FE(%) enterprises seem relatively less likely to be an exporter to OEMs or Tier firms. *Ceteris paribus*, (ongoing) technical collaboration does not increase the likelihood of having the OEM/ Tier exporter status; the effect of an FTC is, in fact, adverse. An FTC or a high FE(%) does not even lead to greater export participation.

A comparison of coefficients across XPosi, XlevelOE and XlevelOT equations (Tables 3 and 4) suggests interesting, though generally expected patterns. For example the favourable effect of SalesL is the highest and most significant for XlevelOE, and the smallest and the weakest for XPosi. Again, the Quality-related variables are most significant for XlevelOE, and the least (in fact, not) significant for XPosi. Also for XlevelOE, QClevel3 exerts a more favourable influence than QClevel2. However, compared to QClevel1, both QClevel3 and QClevel2 certifications lead to an equally higher likelihood of XlevelOT; i.e. their positive effect is similar. Having a trademark (TM) affects mainly the XPosi, but not the XlevelOE.

**Export Intensity and Exports Log**

Table 5 reports the results of export intensity and exports-log equations; the latter variable is better explained. These regressions are obtained for the set of exporters. A bigger size of the firm leads to a considerable adverse effect on the export intensity. The elasticity of exports with respect to sales is close to 0.6 (coefficient on SalesL in

ExportsL Eq.). *Ceteris paribus*, non-company firms export relatively more. The company trademark has a weak positive effect.

Firms emphasizing quality by way of having a Quality Incharge show a superior export performance. Further, adopting ISO/16949 has a large favourable effect on the firm's exports (ExportsL); the effect is not significant on Xint. QClevel2 seems to have a negative effect on the export intensity. Thus if the aim was just to increase total exports, 'be it in the aftermarket', ISO 9000 certification has worked as well as or perhaps better than QS-9000/ E-mark. R&D or HRD Incharge variable has no significant influence.

Considering the foreign collaboration characteristics, having a pure technical collaboration makes the firm less export-oriented in terms of the export intensity and value of sales. The PTCDum coefficient is consistently large, negative and significant. There are no significant differences across foreign nationalities. Financial collaboration (pure or FTC) by Large firms does not affect the amount or intensity of their exports. However, in the case of SMEs a foreign financial collaboration seems to curb the general tendency of SMEs to export more heavily (i.e. having higher export intensity) than Large firms. This is seen through the negative coefficient on FCD_SME variable.

The results also highlight the influence of location factors. Chennai-based firms are among the most successful exporters. ClusSBH (cluster Bangalore/ Hosur) has a positive coefficient but is generally insignificant. In terms of export intensity the Northern region seems to perform better (than West and East regions) but Faridabad cluster firms export less heavily. Among exporters, the 'isolated' firms (Isol=1) manage to export at least as much as 'non-isolated' firms, if not more.

**4. Conclusions and Policy Implications**

By way of new evidence, this study considers the role of a number of firm-specific variables, including the foreign collaboration characteristics, as well as the influence of locational factors in determining the adoption of high quality standards certification, and being an exporter to OEMs or to OEMs/ Tier firms. The analysis pertains to a sample of auto component firms in India during 2004-05. In this Section we focus mainly on the firm size-related empirical findings of this inquiry. Some policy suggestions are also offered in this regard. Our observations regarding the institutional support and cluster programs for automotive SMEs are mentioned mainly in Section 2 and Appendix 1 only. A recent study by the author (Singh 2006) discusses in detail what institutional measures can strengthen the capabilities of auto component SMEs; see also Singh(2004).

While ISO 9000 quality certification may suffice equally for aftermarket exports, for direct exports to OEMs, i.e. vehicle assemblers, the globally harmonized quality standards ISO/TS 16949 certification counts a lot. For exports to OEMs/ high Tier companies (the combined OEM and/or Tier exporter status), both the ISO/TS 16949 and QS-9000/ E-mark, i.e. the globally accepted standards, seem to have worked significantly better than ISO 9000 standards. The empirical analysis in this study points to much lower likelihood of adoption (holding) of ISO/TS 16949 certification by smaller firms/ SMEs.

The results indicate that at present the export participation does not depend on the acquisition of globally harmonized quality standards (ISO/TS 16949) or on having a quality incharge. However, the exports volume (ExportsL) does depend. Again over time the aftermarket itself is becoming more competitive, with many global automotive firms intensifying their sales efforts in this segment. Thus in near future the export participation in a major way even in the aftermarket or lower Tiers is likely to require more rigorous quality standards.

Also with the domestic market becoming more competitive and quality-conscious, high quality standards would be necessary for any SME even to supply to domestic OEMs or high Tier companies in a significant way, and to get out of the trap of 'low quality, low price and essentially aftermarket supplier'. Even the replacement market share will shrink for low capability firms (Chaturvedi 2003).

In future the ISO/TS 16949 certification is likely to be even more important to have a 'visible' international presence through OEM/ Tier exports. Hence for promoting the exports to OEMs and Tier 1 or 2 companies in relative terms it is imperative to re-structure the financial assistance and other schemes of institutional support for quality certification and upgradation. At present the financial assistance seems limited to the acquisition of ISO 9000 quality certification, and probably to the company sector only (not non-companies). In the light of our results, facilitating pure technical collaboration and in the case of SMEs, even financial collaboration seem to be other possible routes for indirectly encouraging an upgradation of quality standards, though not necessarily for promoting the chances of being an OEM/ Tier exporter, or the exports volume/ intensity.

Again, the markets for quality certification process are notoriously imperfect (Humphrey and Memedovic 2003); SMEs find it hard to assess their needs and the service providers. The (perceived) reliability of the ISO 9000 certifying private local agencies must be ensured as most SMEs cannot afford the ISO/TS 16949 certification. Intellectual property issues are acquiring greater importance, as highlighted by ITC/ACMA(2004). We find that having a trademark improves the likelihood of export participation, and being an OEM/ Tier-level exporter.

Our results indicate that even with similar quality (certification) standards, compared to bigger firms, smaller firms are less likely to export to OEMs or Tier firms. There should be some promotional/ incentive scheme for these exports at least for SMEs. More important, it would be especially desirable to provide the exports-related legal assistance and information to SMEs, to review the market development assistance schemes, and evolve better financing options for R&D and technology improvement and for export marketing efforts.

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**Appendix 1: Cluster Programs for Auto Component SMEs in India**

[*Note*: Based on Assaf, 2003; ACMA, CII and UNIDO sources; the author's discussion with some Cluster member companies and Counselors/ Experts.]

Since 1996 UNIDO in cooperation with SSI agencies in India has been engaged in an upgradation of under-achieving small firms, beginning with a comprehensive report on the Indian SME clusters. In Nov. 1998 the UNIDO Partnership program was launched for the Indian automotive component industry. A major purpose was to enhance the performance of 2nd and 3rd Tier SME manufacturers to be globally competitive. Considering the need for similar assistance to its other members, ACMA has also been operating a cluster program through its Division, the ACMA Centre for Technology, ACT. The ACT/ACMA clusters cater to at least Rs. 50 crores sales turnover firms, while the UNIDO-ACMA (ACT) clusters cover below Rs. 50 crores turnover firms. There is a close interaction among counselors/ Experts for these clusters operated regionally.

These cluster programs seek to transform companies into Lean Manufacturing organizations through a training module on Best Practices customized for use by SMEs. The program provides shop-floor interventions and on-site guidance for implementing the recommended practices. The industry experts are relatively few and expensive. Therefore, independent SMEs without any foreign collaboration, or even those having technical agreements and/or minority foreign stake but not obtaining continuous technical assistance from the collaborator, may find this program cost-effective and useful.

The training module has been evolving with the learning experience of the experts and the organizations involved, and with periodic training of the experts themselves. The Sundaram Clayton Group has been deeply associated with these programs, as they have shared their own best practices - partly acquired through import of technology and locally adapted. The Program module is broken into several sub-modules for implementation, e.g. 5-S (Sort-Straighten-Sweep-Standardize-Self-discipline), 3-M, etc. The duration of a cluster is 24-30 months.

Participation in these counseling clusters is against payment. For the UNIDO clusters the three major Partners – UNIDO, Government of India and ACMA - bear part of the expenses, and jointly design and implement the structure. To our information, the fee for the ACT clusters is Rs. 6 lakhs. For (Phase II) UNIDO clusters it is in 3 instalments, each of 0.1% of gross sales turnover (minimum Rs. 1 lakh each). The UNIDO clusters are open only to ACMA members (for which there is ACMA fees), and it is mandatory for a Rs. 10-50 crores turnover firm to be ISO certified. These apart, there are short-run costs associated with organizational changes required under the program, attending review meetings, and hosting in turn the review meetings and plant visits for the cluster participants. Therefore a high degree of initial motivation is required.

Phase I of the UNIDO cluster initiated in 1999, covering only 20 firms from the Western region, focused on non-capital changes and "good house-keeping" practices (Assaf 2003: 394). Phase II extended to all the four regions, covering a total of 40 firms. Currently for both the ACT and UNIDO clusters the Phase III is being conducted.

For this study the author attended the Northern region Review Meetings of both ACT and UNIDO Clusters Phase III held in April 2006, and had also informal discussions with the participants; this provided much insights. The members shared their experience, expectations and benefits from the cluster program. The counselors/ experts examined minutely the different operations at the host company factory - appreciating the improvements and pointing out any slackness. The non-host company participants suggested modifications, and mentioned 'carry home' good points. There was also a short visit to a 'model' company, employing good practices, like an earlier cluster participant. These factory visits create better awareness and demonstration effects.

Data on key performance indicators pertaining to quality, cost and delivery is presented by member firms at the periodic review meetings, and compared against the baseline survey. These indicators are defects ppm, labour and overall productivity, inventory turnover, delivery schedule achievement, space utilization, etc. According to the counselors, a substantial difference is noticed within a year, or even within a few months. The benefits are also in terms of the reduction of energy, wastage, absenteeism, lead-time for production, and preparation time for customer visits; an increase in in-plant training and interaction with workforce; and better capability to meet rush orders. The participating firms feel that this program increases their awareness of the best quality standards, management and organizational practices and of the potential demands of foreign markets, and is instrumental to a dramatic change in mindset and to a culture of continuous improvement. The dynamics of group activity and sharing of experiences contributes to the improvement in competitiveness.

Though these clusters have so far covered only a small minority of the auto component SMEs, the long-term benefits are far-reaching. This set of firms, by applying the best locally-suitable practices, can provide in near future a strong middle layer to the Indian auto components industry. Some of them would also diffuse the 'technology' to their lower Tier firms and their parts & materials suppliers. Moreover, some of these firms have related establishments in this sector, and/or planning to set up new plants in near future. So those units would gain indirectly.

However, any direct association of OEMs and Tier-1 automotive companies in India with the UNIDO and ACT cluster programs for SMEs has been limited so far. Nor have these programs involved much the local engineering and other training institutes in this pursuit, though this participation has been improving. Both these types of linkages and integration, envisaged at the beginning of the program, are crucial for regular updating of the training modules for industrial application. Chennai has been somewhat of an exception in both these regards.

The ACT and UNIDO cluster programs work in strategic alliance with the Confederation of Indian Industries, CII. The CII has also conducted separately a few more clusters for automotive SMEs, e.g. Prof. Tsuds's cluster, TPM clusters for suppliers of a few vehicle assemblers and Tier-1 firms (for Bajaj, TVS, Maruti, Sona Koyo and Pricol), and Gurgaon Cluster. The CII-Thapar Centre for Competitiveness has been providing advisory services to SMEs regarding Total Quality and Energy Management.

**Table 1: Select Averages by Firm Size and Foreign Ownership**

| Variable↓ | Size | | | | All | Ownership | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Small | Medium | SME | Large | | Local | Foreign | <50% FE | >=50% FE |
| Sales | 4.194 | 5.516 | 4.786 | 35.390 | 22.190 | 16.976 | 43.973 | 48.279 | 35.779 |
| QC | 0.865 | 0.911 | 0.886 | 0.966 | 0.931 | 0.928 | 0.944 | 0.932 | 0.968 |
| QClevel3 | 0.270 | 0.389 | 0.323 | 0.675 | 0.524 | 0.476 | 0.722 | 0.695 | 0.774 |
| QClevelG | 0.369 | 0.578 | 0.463 | 0.849 | 0.682 | 0.628 | 0.911 | 0.915 | 0.903 |
| Qinch | 0.505 | 0.622 | 0.557 | 0.675 | 0.624 | 0.598 | 0.733 | 0.712 | 0.774 |
| HRDinch | 0.306 | 0.422 | 0.358 | 0.551 | 0.468 | 0.436 | 0.600 | 0.610 | 0.581 |
| RDinch | 0.288 | 0.467 | 0.368 | 0.479 | 0.431 | 0.394 | 0.589 | 0.627 | 0.516 |
| Xinch | 0.514 | 0.700 | 0.597 | 0.751 | 0.685 | 0.684 | 0.689 | 0.712 | 0.645 |
| XPosi | 0.432 | 0.722 | 0.562 | 0.762 | 0.676 | 0.654 | 0.767 | 0.797 | 0.710 |
| XlevelOE | 0.108 | 0.156 | 0.129 | 0.340 | 0.249 | 0.218 | 0.378 | 0.424 | 0.290 |
| XlevelOT | 0.270 | 0.400 | 0.328 | 0.566 | 0.464 | 0.431 | 0.600 | 0.678 | 0.452 |
| Xint | 16.418 | 18.811 | 17.490 | 14.747 | 15.930 | 16.888 | 11.927 | 11.029 | 13.636 |
| FCD | 0.108 | 0.144 | 0.124 | 0.245 | 0.193 | 0 | 1 | 1 | 1 |
| PTCDum | 0.045 | 0.133 | 0.085 | 0.253 | 0.180 | 0.154 | 0.289 | 0.322 | 0.226 |
| FTCDum | 0.063 | 0.078 | 0.070 | 0.140 | 0.109 | 0 | 0.567 | 0.661 | 0.387 |
| TCDum | 0.108 | 0.200 | 0.149 | 0.340 | 0.258 | 0.154 | 0.689 | 0.763 | 0.548 |
| PureTC | 0.054 | 0.144 | 0.095 | 0.479 | 0.313 | 0.242 | 0.611 | 0.712 | 0.419 |
| TC | 0.117 | 0.233 | 0.169 | 0.638 | 0.436 | 0.242 | 1.244 | 1.424 | 0.903 |
| Low_FED | 0.063 | 0.067 | 0.065 | 0.174 | 0.127 | 0 | 0.656 | 1 | 0 |
| High_FED | 0.045 | 0.078 | 0.060 | 0.072 | 0.067 | 0 | 0.344 | 0 | 1 |
| N | 111 | 90 | 201 | 265 | 466 | 376 | 90 | 59 | 31 |

**Table 2: Logistic Regression Estimates of ISO/TS 16949 Quality Certification Eq. (QClevel3)**

N=466

| Explanatory Variable ↓ | **Coeff.** | **Odds-Ratio** | **Coeff.** | **Odds-Ratio** | **Coeff.** | **Odds-Ratio** |
|---|---|---|---|---|---|---|
| SalesL | 0.657 | 1.929 | 0.606 | 1.832 | 0.598 | 1.819 |
| | (7.039) | | (6.811) | | (7.141) | |
| Age | 0.067 | 1.069 | 0.060 | 1.062 | 0.056 | 1.057 |
| | (1.919) | | (1.726) | | (1.639) | |
| Age2 | -0.0015 | 0.9985 | -0.0013 | 0.999 | -0.0013 | 0.999 |
| | (2.244) | | (2.060) | | (1.963) | |
| FCD | -0.561 | 0.571 | | | | |
| | (1.468) | | | | | |
| FCD_SME | 1.458 | 4.299 | | | | |
| | (2.389) | | | | | |
| Low_FED | | | -0.315 | 0.730 | | |
| | | | (0.842) | | | |
| High_FED | | | 0.491 | 1.634 | | |
| | | | (0.892) | | | |
| Germany | 1.458 | 4.299 | 1.465 | 4.326 | 1.509 | 4.522 |
| | (2.013) | | (1.979) | | (2.212) | |
| PTCDum | 1.164 | 3.202 | 1.145 | 3.141 | 1.115 | 3.048 |
| | (3.716) | | (3.648) | | (3.581) | |
| South | 0.721 | 2.056 | 0.763 | 2.145 | 0.743 | 2.103 |
| | (2.742) | | (2.919) | | (2.879) | |
| ClusNG | 0.703 | 2.019 | 0.697 | 2.008 | 0.675 | 1.964 |
| | (2.119) | | (2.118) | | (2.052) | |
| Constant | -2.227 | | -2.062 | | -2.003 | |
| | (4.998) | | (4.761) | | (4.717) | |
| LR Chi2 | 128.32 | | 124.19 | | 122.00 | |
| Psuedo R2 | 0.199 | | 0.193 | | 0.190 | |

Note: Parentheses contain Z-values.

**Table 3: Logistic Estimates - Export Participation and 'Level' (XPosi; XlevelOE, XlevelOT)**

N=466

| Explanatory Var. ↓ | **XPosi Eq.** | **XlevelOE Eq.** | | **XlevelOT Eq.** | |
|---|---|---|---|---|---|
| SalesL | 0.137 | 0.491 | 0.483 | 0.260 | 0.196 |
| | (1.746) | (4.795) | (4.921) | (3.119) | (2.395) |
| Age | 0.037 | | | | |
| | (3.620) | | | | |
| OthD | | 0.668 | | | |
| | | (1.428) | | | |
| TM | 1.026 | | | 0.408 | 0.432 |
| | (4.504) | | | (1.888) | (2.020) |
| HRDinch | 0.644 | | | | |
| | (2.824) | | | | |
| Qinch | | 0.587 | 0.591 | | |
| | | (2.272) | (2.298) | | |
| QClevel3 | | 1.011 | 0.701 | | |
| | | (2.901) | (2.678) | | |
| QClevel2 | | 0.596 | | | |
| | | (1.403) | | | |
| QClevel1 | | | | -1.007 | -1.046 |
| | | | | (3.625) | (3.774) |
| FCD_SME | | | | | -0.876 |
| | | | | | (1.497) |
| High_FED | | -1.063 | -1.109 | -1.830 | |
| | | (1.947) | (2.022) | (3.079) | |
| Germany | | 1.285 | 1.297 | 2.133 | 1.579 |
| | | (2.145) | (2.168) | (2.886) | (2.390) |
| USA | | 0.892 | 0.959 | 2.445 | 1.804 |
| | | (1.367) | (1.462) | (2.973) | (2.374) |
| OthNat | | 1.609 | 1.663 | 2.041 | 1.499 |
| | | (2.739) | (2.855) | (2.783) | (2.208) |
| FTCDum | | -0.808 | -0.844 | -0.777 | -0.684 |
| | | (1.947) | (2.039) | (1.961) | (1.737) |
| PTCDum | 0.427 | | | | |
| | (1.318) | | | | |
| North | | -0.419 | -0.405 | | |
| | | (1.600) | (1.553) | | |
| South | | | | -0.384 | |
| | | | | (1.352) | |
| ClusNF | | -1.205 | -1.161 | -0.828 | -0.830 |
| | | (1.839) | (1.784) | (2.106) | (2.140) |
| ClusSC | 1.412 | | | 1.989 | 1.612 |
| | (2.152) | | | (3.530) | (3.210) |
| Isol_SME | -1.599 | | | -1.648 | -1.737 |
| | (3.042) | | | (2.111) | (2.232) |
| Constant | -1.173 | -3.186 | -2.825 | -0.625 | -0.589 |
| | (4.362) | (7.815) | (8.240) | (2.411) | (2.332) |
| LR Chi2 | 95.21 | 86.38 | 82.94 | 110.77 | 100.09 |
| Psuedo R2 | 0.162 | 0.165 | 0.159 | 0.172 | 0.156 |

Note: Parentheses contain Z-values. Odds-Ratio reported in Table 4.

**Table 4: Odds-Ratio - Export Participation and 'Level' Eq. (XPosi; XlevelOE, XlevelOT)**

N=466

| Explanatory Variable ↓ | **XPosi Eq.** | **XlevelOE Eq.** | | **XlevelOT Eq.** | |
|---|---|---|---|---|---|
| SalesL | 1.147 | 1.634 | 1.620 | 1.297 | 1.216 |
| Age | 1.037 | | | | |
| OthD | | 1.951 | | | |
| TM | 2.791 | | | 1.504 | 1.541 |
| HRDinch | 1.904 | | | | |
| Qinch | | 1.799 | 1.805 | | |
| QClevel3 | | 2.750 | 2.015 | | |
| QClevel2 | | 1.816 | | | |
| QClevel1 | | | | 0.365 | 0.351 |
| FCD_SME | | | | | 0.417 |
| High_FED | | 0.345 | 0.330 | 0.160 | |
| Germany | | 3.615 | 3.660 | 8.442 | 4.849 |
| USA | | 2.440 | 2.608 | 11.534 | 6.077 |
| OthNat | | 4.998 | 5.273 | 7.696 | 4.479 |
| FTCDum | | 0.446 | 0.430 | 0.460 | 0.505 |
| PTCDum | 1.533 | | | | |
| North | | 0.657 | 0.667 | | |
| South | | | | 0.681 | |
| ClusNF | | 0.300 | 0.313 | 0.437 | 0.436 |
| ClusSC | 4.103 | | | 7.311 | 5.015 |
| Isol_SME | 0.202 | | | 0.192 | 0.176 |

Note: Odds-Ratio Estimates for logistic regressions in Table 3.

**Table 5: Regressions of Export Intensity (Xint) and Exports-log (ExportsL)**

N=296

| Explanatory Variable ↓ | **Xint Eq.** | | **ExportsL Eq.** | |
|---|---|---|---|---|
| SalesL | -6.012 | -6.006 | 0.611 | 0.604 |
| | (5.401) | (5.390) | (9.746) | (9.464) |
| OthD | 13.280 | 14.111 | 0.460 | 0.432 |
| | (2.266) | (2.416) | (1.437) | (1.336) |
| TM | | | 0.238 | |
| | | | (1.369) | |
| Qinch | 4.266 | 4.365 | 0.304 | 0.340 |
| | (1.379) | (1.410) | (1.812) | (2.026) |
| QClevel3 | | | 0.369 | |
| | | | (2.138) | |
| QClevel2 | -6.406 | -5.767 | | -0.362 |
| | (1.676) | (1.495) | | (1.690) |
| QClevel1 | | | | -0.399 |
| | | | | (1.788) |
| FCD_SME | -9.550 | | -0.581 | -0.530 |
| | (1.459) | | (1.628) | (1.481) |
| PTCDum | -9.451 | -9.383 | -0.657 | -0.619 |
| | (2.604) | (2.584) | (3.296) | (3.130) |
| North | 5.352 | 6.557 | | |
| | (1.647) | (1.964) | | |
| ClusNF | -12.133 | -12.139 | | |
| | (2.218) | (2.217) | | |
| ClusSC | 7.941 | 9.204 | 0.704 | 0.781 |
| | (1.526) | (1.745) | (2.573) | (2.819) |
| ClusSBH | | 8.181 | | |
| | | (1.309) | | |
| Isol | | | | 0.314 |
| | | | | (1.407) |
| Constant | 36.849 | 34.990 | 5.125 | 5.577 |
| | (8.817) | (8.357) | (21.399) | (24.004) |
| F-value | 8.98 | 8.92 | 19.74 | 17.50 |
| R-squared | 0.220 | 0.219 | 0.355 | 0.355 |
| Adj R-sq | 0.196 | 0.195 | 0.337 | 0.335 |

Note: Parentheses contain Z-values.